First Article Test Report.pdf	(FAT Program & TRs) see below list
Structural Analysis Report.pdf	(MCF CEN Equipment)
TP-1073-AR-1.pdf	(Lift Casting Static Load)
TP-1073-AR-002.pdf	(Module Construction Exam)
TP-1073-AR-003.pdf	(Module Lifting Test)
DAAK-73-D0007.pdf	(Structural Analysis Report)
B950201.pdf	(MCF Vibration Testing 1995)
TP-1073-AR-016.pdf	(MCF Vibration Testing 1996)
TP-1073-AR-019.pdf	(MCF Module Compatibility)
TP 1073-AR-042.pdf	(Sea/Beach Module FAT)

Appendix A	Test Report TP-1073-AR-011, Rev. (C), "Centralize Propulsion and Maneuvering Trials"
Appendix B	Test Report TP-1073-AR-012, Rev. (D), "Speed Trials"
Appendix C	Test Report TP-1073-AR-013, Rev. (A), "Fuel Consumption"
Appendix D	Test Report TP-1073-AR-014, Rev. (B), "Ventilation"
Appendix E	Test Report TP-1073-AR-015, Rev. (C), "Noise Level"
Appendix F	Test Report TP-1073-AR-016, Rev. (A), "Vibration Measurements"
Appendix G	Test Report TP-1073-AR-020, Rev. (C), "Emergency Anchor System"
Appendix H	Test Report TP-1073-AR-023, Rev. (A), "Rail Impact Test"

RETURN TO INDEX

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

DATE September 28, 1994

TP-1073-AR-003
CDRL A010

P40 P001
P20 RR003

MODULE LIFTING TEST
TEST PROCEDURE

TP-1073-AR-003

CUSTOMER ATCOM

CUSTOMER JOB NO. N/A

CUSTOMER P.O. NO. DAAK01-93-D-0007

HULL NOS. N/A

EQUIPMENT All Causeway Ferry

EQUIPMENT NO.

EQUIPMENT SERIAL NO(S)

CUSTOMER NOTIFICATION PRIOR TO TESTING 2 Weeks

ENGINEERING NOTIFICATION PRIOR TO TESTING None

LAKE SHORE SALES ORDER NO. 1073AR

DRAWN W Keller DATE 9-30-94

CHECKED R M Sherowski DATE 9-30-94

APPROVED W Keller DATE 9-30-94

QUALITY ASSURANCE R Dawson DATE 10/3/94

REV.	DATE	APP'D BY	Q.A.	DESCRIPTION
A	OCT 20, 1994	RMS	LSI 1 QA	REVISED TO INCORP NSWC CADEROCK DIV COMMENTS RECEIVED OCT. 20, 1994
B	OCT 31, 1994	WJK	LSI 1 QA	REVISED SECTIONS 3, 1, 5 AND 6 TO INCOPORATE COMMENTS OF T. OSMARICH LTR 1073-TJC-3938P. ADDED TOLERANCES TO 5.1 AND NOMENCLATURE TO T.R-003.

TP-1073-AR-003
CDRL A010

MODULE LIFTING TEST
TEST PROCEDURE

TP-1073-AR-003

1.0 PURPOSE

1.1 Purpose of this test is to demonstrate that each module design type meets the requirements of paragraph 4.5.2.1 of Reference 2.1.

2.0 REFERENCES

2.1 Purchase Description P.D. 1990-0098

2.2 ISO 668

2.3 ISO 1161

2.4 LSI Drawing T-1931, Test Fixture - Lifting Spreader

3.0 EQUIPMENT REQUIRED

3.1 CFE.

The following Contractor Furnished Equipment (CFE) is required:

- Lifting spreader bars
  - Two 8' bars minimum capacity 15 tons each
  - One special spreader per Reference 2.4
- Dead weight equal to the weight of:
  - One 20' Module (approximately 11,700#)
  - One 40' Powered Module (approximately 38,600#; plus component dead wts 15,700#)
- One module of each type:
  - One 20' Module
  - One 40' Powered Module

3.2 GFE. None

4.0 INSPECTION CRITERIA

4.1 Following testing the modules shall be inspected for the following defects:

- Any signs of permanent deformation or other abnormalities resulting from lift tests.

- Changes in dimensional requirements affecting module handling, securing or interchange resulting from lift test.

5.0 ACCEPTANCE CRITERIA

5.1 Any permanent deformation resulting in module dimensional changes greater than ISO 668 and 1161 requirements shall be cause for rejection of the module. Final module dimensions tolerances shall be +0/-3/8 for length, +0/-3/16 width and height.

6.0 PROCEDURE

6.1 Inspect module per TP-1073-AR-002 noting any irregularities.

6.2 On 40' module mark and measure length at top and bottom and two diagonals on each side. On 20' module mark and measure deck length and one diagonal on each side. Measure points should be center-punch located in appropriate area of ISO corner castings.

6.3 Apply a uniform load such that the module and test load equal twice the weight of the module. Power module dead weight to include weight of any missing components.

6.4 Slowly lift module and hold in air for five minutes while suspended vertically from the four top corner fittings.

6.4.1 Inspect module for any permanent deformations resulting from vertical lift test. Record per paragraph 7.0.

6.5 Suspend module at 30° ($\pm$3°) from the four bottom corner fittings, (except raked module and sea/beach module, which are not applicable) using spreader of Reference 2.4 for a period of five minutes.

6.6 Inspect module following bottom corner suspension for any permanent deformation resulting from this test. Record measurement per 7.0.

7.0 REPORTING

7.1 Form TR-1073-AR-003 shall be used for all reporting of results of this test.

7.2 All final dimensions shall be recorded and reviewed by customer and LSI engineering.

7.3 Customer's representatives presence is required for this test.

TR-1073-AR-003
CDRL A010

MODULE LIFT TEST
TEST REPORT

TR-1073-AR-003

CUSTOMER ATCOM

CUSTOMER CONTRACT DAAK01-93-D-0007

EQUIPMENT Causeway Ferry Pontoons

SHOP ORDER _____

TEST COMPLETION DATE 1 NOV 94

Record the following for each module:	Acceptable	Not Acceptable
Verify equipment is in current calibration	OK	
Gauges in current calibration	N/A	
Tape measure in current calibration	YES	

Module Serial Number Powered - 40FTP #001

Total Weight of Lift Test 77,031 #

Dimensional check results.

TOP LIFT TEST Top Punch Marks In different locations from Bottom LIFT	Dimension Prior To Test	Dimension Post Test	Acceptable	Not Acceptable
Length at Top R	38' 10 3/8"	38' 10 7/16"	Yes	
Length at Bottom R	39' 8 1/2"	39' 8 1/2"	Yes	
Length at Top L	38' 10 3/16"	38' 10 3/16"	Yes	
Length at Bottom L	39' 8 5/8"	39' 8 5/8"	Yes	
Diagonal "A" R (Fwd Top)	39' 5 5/16"	39' 6"	Yes	
Diagonal "B" R (Fwd Bottom)	39' 6"	39' 6"	Yes	
Diagonal "A" L (Fwd Top)	39' 6"	39' 6"	Yes	
Diagonal "B" L (Fwd Bottom)	39' 5 7/8"	39' 5 15/16"	Yes	

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

DATE September 28, 1994

TR-1073-AR-003
CDRL A010

BOTTOM LIFT TEST	Dimension Prior To Test	Dimension Post Test	Acceptable	Not Acceptable
Length at Top R	39' 8 7/16"	39' 8 7/16"	Yes	
Length at Bottom R	39' 8 3/4"	39' 8 3/4"	Yes	
Length at Top L	39' 8 11/16"	39' 8 11/16"	Yes	
Length at Bottom L	39' 8 7/8"	39' 8 15/16"	Yes	
Diagonal "A" R (Fwd Top)	39' 11 1/16"	39' 11 1/16"	Yes	
Diagonal "B" R (Fwd Bottom)	39' 11 5/8"	39' 11 5/8"	Yes	
Diagonal "A" L (Fwd Top)	39' 11 5/8"	39' 11 5/8"	Yes	
*Diagonal "B" L (Fwd Bottom)	39' 11 11/16"	39' 11 1/2"	yes	

20' MODULE S/N P20RR #003 Total Wt. of Lift Test 24,350

NOTES				
LENGTH @ TOP L	18' 9 5/16"	18' 9 5/16"	Yes	
LENGTH @ TOP R	18' 9 1/8"	18' 9 1/8"	yes	
DIAGONAL L	19' 1 3/4"	19' 1 3/4"	Yes	
DIAGONAL R	19' 1 11/16"	19' 1 11/16"	Yes	
END TOP LENGTH	7' 9 7/8"	7' 9 7/8"	yes	
END Bottom Length	7' 9 15/16"	7' 9 15/16"	Yes	
Top L - Bottom R Diagonal	8' 11 9/16"	8' 11 1/2"	yes	
Top R - Bottom L Diagonal	8' 11 1/2"	8' 11 1/2"	yes	

Test Witnessed by:

LSI QA Daryl Bailey 11-1-94, Customer Rep 1 NOV 94 Other _____

LSI Engineering W Heller 11/1/94

50 FT. STARRETT TAPE S/N WMQC-003 Calib. Due 7/11/99 Last cal 7/11

SEE SA OF 5 FOR TRANSDUCERS

Bottom Lift Test - 40P

5A 05 5

	Prior	Post	Acceptable
Length Top Forward	7'9 1/4"	7'9 5/16"	yes
Length Bottom Forward	7'9 5/16"	7'9 5/16"	yes
Top L - Bottom R Diagonal	8'10 7/8"	8'10 15/16"	yes
Top R - Bottom L Diagonal	8'10 9/16"	8'10 9/16"	yes
Length Top AFT	7'9 7/8"	7'9 7/8"	yes
Length Bottom AFT	7'9 7/8"	7'9 7/8"	yes
Top L - Bottom R. AFT	8'11 1/16"	8'11 1/16"	yes
Top R - Bottom Left AFT	8'11 9/16"	8'11 1/2"	yes

Top Lift Test - 40P

	PRIOR	POST	ACCEPTABLE
Length Top Forward	7'9 5/16"	7'9 5/16"	yes
Length Bottom Forward	7'9 5/16"	7'9 5/16"	yes
Top L - Bottom R Diagonal	8'10 15/16"	8'10 15/16"	yes
Top R - Bottom L Diagonal	8'10 9/16"	8'10 9/16"	yes
Length Top AFT	7'9 7/8"	7'9 7/8"	yes
Length Bottom AFT	7'9 7/8"	7'9 7/8"	yes
Top L - Bottom R AFT	8'11 1/16"	8'11 1/16"	yes
Top R - Bottom L AFT	8'11 1/2"	8'11 1/2"	yes

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

DATE September 28, 1994

TP-1073-AR-004
CDRL A010

LONGITUDINAL RESTRAINT TEST PROCEDURE

TP-1073-AR-004

CUSTOMER ATCOM

CUSTOMER JOB NO. N/A

CUSTOMER P.O. NO. DAAK01-93-D-0007

HULL NOS. N/A

EQUIPMENT All Causeway Ferry

EQUIPMENT NO.

EQUIPMENT SERIAL NO(S)

CUSTOMER NOTIFICATION PRIOR TO TESTING 2 Weeks

ENGINEERING NOTIFICATION PRIOR TO TESTING None

LAKE SHORE SALES ORDER NO. 1073AR

DRAWN W Kelley DATE 9-30-94

CHECKED D M Stumph DATE 9-30-94

APPROVED W Keller DATE 9-30-94

QUALITY ASSURANCE R Mattson 'DATE 10/3/94

REV.	DATE	APP'D BY	Q.A.	DESCRIPTION
A	10/31/94	WJK	LSI 1 QA	REVISED SECTIONS 3.1, 5 AND 6 TO INCORPORATE COMMENTS OF TSARICH LETTER OF 10/27/94 S/N 1073-NC-3938. CHANGED TEST LOAD TO 80K IN LIEU OF 2X MOORING IN P 6.0 CLARIFIED ACCEPTANCE PROCEDURE IN P 5.0.

TP-1073-AR-004
CDRL A010

LONGITUDINAL RESTRAINT TEST PROCEDURE

TP-1073-AR-004

1.0 PURPOSE

1.1 Purpose of this test is to demonstrate that each module design type meets the longitudinal restraint requirements of paragraph 4.5.2.2 of Reference 2.1.

2.0 REFERENCES

2.1 Purchase Description P.D. 1990-0098

2.2 ISO 668

2.3 ISO 1161

2.4 LSI Drawing T-1932, Longitudinal Restraint Test Fixture

3.0 EQUIPMENT REQUIRED

3.1 CFE.

The following Contractor Furnished Equipment (CFE) is required:

- Module restraining and test fixture per Reference 2.4.
- Hydraulic cylinder, 50 ton capacity, Model RC-506 or equal, effective area of pistons 11.045 sq./in.
- HPU with current calibration.
- One 40' Module

NOTE: Test cannot be performed on sea/beach or raked modules.

3.2 GFE.

None

4.0 INSPECTION CRITERIA

4.1 Following testing the modules shall be inspected for the following defects resulting from restraint test.

- Any signs of permanent deformation or other abnormalities.
- Changes in dimensional requirements affecting module handling, securing or interchange.

5.0 ACCEPTANCE CRITERIA

5.1 Any permanent deformation resulting in module dimensional tolerance change greater than the following final dimensions shall be cause for rejection of the module:

5.1.1 +0/-3/8 Length

5.1.2 +0/-3/16 height and width.

6.0 PROCEDURE

6.1 Prior to testing inspect module per TP-1073-AR-002. Note any existing deformations.

6.2 Measure and mark diagonal and length dimensions prior to applying loads.

6.2.1 Weight of module + machinery is 38,600#.

6.2.2 Test Module to 80,000# to allow for machinery foundations.

6.3 Pressure on cylinder for pushing and pulling is obtained from the following equation: *NOTE: This rest requires two cylinders.*

$P = F/A$

P = Pressure on Cylinder

F = Force for Test (80,000#)

A = Area of one Cylinder = 11.045 $in.^2$

A_T = Area of two cylinders = 22.09 $in.^2$

Thus,

$P = (80{,}000\#)/22.09\ in.^2 = 3622$ PSIG

6.4 Restrain module at one end using bottom corner fittings.

6.4.1 Apply a horizontal load of 80,000# through the opposite bottom corner fittings, first towards then away from the restrained fittings.

6.2.2 Hold load five minutes in each direction.

6.5 Following each load application measure and record diagonal and length dimensions.

6.6 Perform on one P40 module only.

7.0 REPORTING

7.1 Form TR-1073-AR-004 shall be used for all reporting of results of this test.

7.2 All final dimensions shall be recorded and reviewed by customer and LSI engineering.

7.3 Customer representative is required to witness this test.

PRESSURE GAGE S/N 880998 CAL. DUE 10-28-95 LAST CAL 10-28-9
PRESSURE GAGE S/N 880999 CAL. DUE 10-28-95 LAST CAL 10-28-
PRESSURE GAGE S/N 880996 CAL DUE 10-28-95 LAST CAL 10-28-9
STARRETT 50' TAPE S/N 881121 CAL DUE 10-28-95 LAST CAL 10-28-9
BRIDGE AMP S/N 884008 CAL DUE 7-29-95 LAST CAL 7-29-9
BRIDGE AMP S/N 884001 CAL DUE 7-1-95 LAST CAL 7-1-94
Stop Watch S/N 881043 CAL DUE 10-28-95 LAST CAL 10-28-94

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

DATE September 28, 1994

TR-1073-AR-004
CDRL A010

LONGITUDINAL RESTRAINT

TEST REPORT

TR-1073-AR-004

CUSTOMER ATCOM

CUSTOMER CONTRACT DAAK01-93-D-0007

EQUIPMENT Causeway Ferry Pontoons

SHOP ORDER _____

TEST COMPLETION DATE 2 NOV 94

Record the following for each module tested:	Acceptable	Not Acceptable
Gauges in current calibration	YES	
Tape in current calibration	YES	
Verify cylinder area of 11.045 in.^{2}	YES	

Module Serial Number P40 #001

Total Load Applied 80,000#

Dimensional check results (see Reference 2.2, 2.3)

~~COMPRESSION~~ TENSION TEST	Dimension Prior To Test	Dimension Post Test	Acceptable	Not Acceptable
Length at Top R	38' 11 1/16"	38' 11 5/8"	YES	
Length at Bottom R	38' 11 3/8"	38' 11 3/8"	YES	
Length at Top L	38' 11 9/16"	38' 11 1/2"	YES	
Length at Bottom L	38' 11 1/4"	38' 11 3/16"	YES	
Diagonal "A" (TOP) R	39' 2"	39' 2"	YES	
Diagonal "B" R	39' 1 7/8"	39' 1 7/8"	YES	
Diagonal "A" (TOP) L	39' 1 7/8"	39' 1 7/8"	YES	
Diagonal "B" L	39' 1 5/8"	39' 1 9/16"	YES	

LSI 03093

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

DATE September 28, 1994

TR-1073-AR-004
CDRL A010

~~TENSION~~ TEST COMPRESSION	Dimension Prior To Test	Dimension Post Test	Acceptable	Not Acceptable
Length at Top R	38' 11 5/8"	38' 11 11/16"	yes	
Length at Bottom R	38' 11 3/8"	38' 11 3/8"	yes	
Length at Top L	38' 11 1/2"	38' 11 1/2"	yes	
Length at Bottom L	38' 11 1/4"	38' 11 3/16	yes	
FWD TOP Diagonal "A" R	39' 1 3/4"	39' 2"	yes	
Diagonal "B" R	39' 2"	39' 1 7/8"	yes	
FWD TOP Diagonal "A" L	39' 1 7/8"	39' 1 7/8"	yes	
Diagonal "B" L	39' 1 3/4"	39' 1 9/16"	yes	

NOTES ______________________________

Test Witnessed by:

LSI Rep Nancy Porier 11-02-94 Customer Rep Donald K Bing 11-02-94 Other ______

LSI Engineering Rep Will J Keller 11-2-94

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

DATE September 28, 1994

TP-1073-AR-005
CDRL A010

MODULE RIGIDITY TEST
TEST PROCEDURE

TP-1073-AR-005

CUSTOMER ATCOM

CUSTOMER JOB NO. N/A

CUSTOMER P.O. NO. DAAK01-93-D-0007

HULL NOS. N/A

EQUIPMENT All Causeway Ferry

EQUIPMENT NO. N/A

EQUIPMENT SERIAL NO(S) N/A

CUSTOMER NOTIFICATION PRIOR TO TESTING 2 WEEKS

ENGINEERING NOTIFICATION PRIOR TO TESTING None

LAKE SHORE SALES ORDER NO. 1073AR

DRAWN W Keller DATE 9-30-94

CHECKED R M Shenarski DATE 9-30-94

APPROVED W Keller DATE 9-30-94

QUALITY ASSURANCE K. M allison DATE 10/3/94

REV.	DATE	APP'D BY	Q.A.	DESCRIPTION
A	Oct 31, 1994	WJK	LSI 1 QA	Revised pp 5 to clarify Acceptance Criteria Revised pp 6.4 and 6.6 to clarify test measurements. Modified TR-005 to clarify diagonal measurements

TP-1073-AR-005
CDRL A010

TEST PLAN
MODULE RIGIDITY TEST

TP-1073-AR-005

1.0 PURPOSE

1.1 Purpose of this test is to demonstrate that each module design type meets the requirements to withstand ship racking forces of paragraph 4.5.2.3 of Reference 2.1.

2.0 REFERENCES

2.1 Purchase Description P.D. 1990-0098

2.2 ISO 668

2.3 ISO 1161

2.4 ISO 1496/1

2.5 LSI Drawing T-1933, Test Fixture Module Racking Test

3.0 EQUIPMENT REQUIRED

3.1 CFE.

The following Contractor Furnished Equipment (CFE) is required:

- Module restraining and test fixture per Reference 2.5.
- Hydraulic cylinder, 50 ton capacity, Model RC-506 or equal, effective area of pistons 11.045 sq./in.
- Hydraulic Power Unit with gauges in current calibration.
- One 40' Powered Module

3.2 GFE.

None

4.0 INSPECTION CRITERIA

4.1 Following testing the modules shall be inspected for the following defects resulting from this test:

- Any signs of permanent deformation or other abnormalities.
- Changes in dimensional requirements affecting module handling, securing or interchange.

5.0 ACCEPTANCE CRITERIA

5.1 End Structure

The sideways deflection of the top of the module with respect to the bottom of the module at the time it is under full transverse rigidity test conditions, shall not cause the sum of the changes in length of the two diagonals to exceed 2 3/8".

5.2 Side Structure

The longitudinal deflection of the module with respect to the bottom of the module at the time it is under full longitudinal rigidity test conditions, shall not exceed 1".

6.0 PROCEDURE

6.1 Inspect modules for completion per procedure TP-1073-AR-002. Note any existing deformations or non-conformities.

6.2 Punch mark locations on side and end to be tested and measure ISO to ISO diagonal reference dimensions. Measure two diagonals per side and end. Record per Section 7.0 of this procedure.

6.3 Traversed Rigidity Test.

The module shall be placed on four level supports, one under each corner fitting, and shall be restrained against lateral and vertical movement by means of anchor devices acting through the bottom apertures of the bottom corner fittings. Lateral restraint shall be provided only at a bottom corner fitting diagonally opposite to the top corner fitting to which force is applied. Vertical restraint shall be applied only at the end frame under test.

A force of 33,000 lbs. shall be applied to the top corner fitting in a line parallel both to the base and to the plane of the end of the module. The force shall be applied first towards and then away from the top corner fittings.

$$P = F/A \quad \therefore \quad P = \frac{33{,}000}{11.045} = 2988 \text{ psi}$$

Only one end shall be tested.

6.4 With transverse racking loads, applied reinspect measured diagonals and record dimensions.

6.5 Longitudinal Rigidity Test.

The module shall be placed on four level supports, one under each corner fitting, and shall be restrained against longitudinal and vertical movement by means of anchor devices acting through the bottom apertures of the bottom corner fittings. Longitudinal restraint shall be provided only at the bottom corner fitting diagonally opposite to and in the same side as the top corner fitting to which force is applied.

Forces of 16,850 lbs. shall be applied to the top corner fitting on one end of the module a line parallel both to the base of the module and to the plane of the sides of the module. The force shall be applied first towards and then away from the top corner fitting.

$$P = F/A \quad \therefore \quad P = \frac{16{,}850}{11.045} = 1526 \text{ psi}$$

Only one side shall be tested.

6.6 With longitudinal racking loads applied, reinspect measured diagonals and record dimensions.

6.7 Longitudinal test cannot be applied to the raked modules or to the beach/sea module.

7.0 REPORTING

7.1 Form TR-1073-AR-005 shall be used for all reporting of results of this test.

7.2 All final dimensions shall be recorded and reviewed by customer and LSI engineering.

7.3 Customer representation is required to witness this test.

TRANSVERSE RESULTS ON REVERSE →

TR-1073-AR-005
CDRL A010

MODULE RIGIDITY TEST

TEST REPORT

TR-1073-AR-005

CUSTOMER ATCOM

CUSTOMER CONTRACT DAAK01-93-D-0007

EQUIPMENT Causeway Ferry Pontoons

SHOP ORDER _____

TEST COMPLETION DATE 2 NOV 94

	Acceptable	Not Acceptable
Module is inspected per paragraph 6.1.	yes	
Test set-up is per reference 2.5.	yes	
Gauges are in current calibration.	yes	
Verify cylinder area of 11.045 in.^{2}	yes	

Record the following for each module:

Module Serial Number P40P # 001

Dimensional check results (see Reference 2.2, 2.3, 2.4)

TRAVERSE TEST	Acceptable	Not Acceptable
NOTE: Diagonal "A" is defined as top corner at point of load.		
Diagonal "A" - Before Test 8' 11"		
Diagonal "A" - During Test 8' 10 15/16" (Push)	yes	
Diagonal "B" - Before Test 8' 10 5/8"		
Diagonal "B" - During Test 8' 10 5/8"	yes	
Diagonal "A" - After Test 8' 10 15/16"		
Diagonal "B" - After Test 8' 10 9/16"		

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

SHEET 6 OF 6
DATE September 28, 1994
REVISED October 31, 1994

TR-1073-AR-005
CDRL A010

Total Load Applied 33,000 lbs at pressure of 3000 PSI.

LONGITUDINAL TEST

NOTE: *Diagonal "A" defined as top corner at point of load.*

	PUSH	PULL	Acceptable	Not Acceptable
Diagonal "A" - Before Test	39' 11 9/16"	39' 11 9/16"		
Diagonal "A" - During Test	39' 11 9/16"	39' 11 9/16"	yes	
Diagonal "B" - Before Test	39' 6 1/8"	39' 6 1/8"		
Diagonal "B" - During Test	39' 6 1/8"	39' 6 1/8"	yes	

Total Load Applied 17,672 at pressure of 1600 PSI.

Test Witnessed by:

LSI Rep [signature] 11/02/94 Customer Rep [signature] Other [signature] 11/2/94
LSI ENG.

Pressure Gage	S/N 880998	Cal. Due 10-28-95	Last Cal. 10-28-94
Pressure Gage	S/N 880999	Cal. Due 10-28-95	Last Cal. 10-28-94
Pressure Gage	S/N 880996	Cal. Due 10-28-95	Last Cal. 10-28-94
Starrett 50' Tape	S/N 881121	Cal. Due 10-28-95	Last Cal. 10-28-94
Bridge Amp.	S/N 884008	Cal. Due 7-29-95	Last Cal. 7-29-94

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

DATE September 28, 1994

TP-1073-AR-006
CDRL A010

P20 CR004

MODULE STACKING TEST
TEST PROCEDURE

TP-1073-AR-006

CUSTOMER ATCOM

CUSTOMER JOB NO. N/A

CUSTOMER P.O. NO. DAAK01-93-D-0007

HULL NOS. N/A

EQUIPMENT All Causeway Ferry

EQUIPMENT NO. N/A

EQUIPMENT SERIAL NO(S) N/A

CUSTOMER NOTIFICATION PRIOR TO TESTING 2 Weeks

ENGINEERING NOTIFICATION PRIOR TO TESTING None

LAKE SHORE SALES ORDER NO. 1073AR

DRAWN W Keller DATE 9.30.94

CHECKED R M Sherarski DATE 9-30-94

APPROVED W Keller DATE 9.30.94

QUALITY ASSURANCE R Mattson DATE 10/3/94

REV.	DATE	APP'D BY	Q.A.	DESCRIPTION
A	Oct 31, 1994	WJK	LSI 1 QA	REVISED #6 AND TR-006 TO REFLECT ONLY ONE CORNER IS TO BE TESTED IN LIEU OF ALL FOUR.

TP-1073-AR-006
CDRL A010

MODULE STACKING TEST
TEST PROCEDURE

TP-1073-AR-006

1.0 PURPOSE

1.1 Purpose of this test is to demonstrate that each module design type meets the stacking requirements of paragraph 4.5.2.4 of Reference 2.1.

2.0 REFERENCES

2.1 Purchase Description P.D. 1990-0098

2.2 ISO 668

2.3 ISO 1161

2.4 LSI Drawing T-1929, Fixture for Stack and Deck Strength

3.0 EQUIPMENT REQUIRED

3.1 CFE.

The following Contractor Furnished Equipment (CFE) is required:

- Restraining and test load fixture per Reference 2.4.
- Hydraulic cylinder, 50 ton capacity, Model RC-506 or equal, effective area of pistons 11.045 sq./in.
- HPU with gauges in current calibration.
- One module randomly selected from first article production.

3.2 GFE.

None

4.0 INSPECTION CRITERIA

4.1 Following testing the module shall be inspected for the following defects:

- Any signs of permanent deformation or other abnormalities.
- Changes in dimensional requirements affecting module handling, securing or interchange.

TP-1073-AR-006
CDRL A010

5.0 ACCEPTANCE CRITERIA

5.1 Any permanent deformation resulting in module dimensions no longer meeting the requirements of references 2.2 and 2.3 shall be cause for rejection of the module.

6.0 PROCEDURE

6.1 NOTE: All LSI MCF modules have identical corner scantlings making testing of each type redundant test only one randomly selected module.

6.2 Inspect module per test plan TP-1073-AR-002 prior to this test. Note any existing deformations.

6.3 Mark a known dimension on one vertical corner fitting pair (approximately 4'-3") and center punch.

6.4 Apply a compressive load of 86,800# to one corner fitting of the module.

$P = F/A \quad \therefore P = 86{,}800/11.045 = 7.859$ psi

USE F = 101,520 #, P = 9192 PSIG

6.5 Hold load for 5 minutes.

6.6 Inspect corner fitting to fitting dimension.

6.7 NOTE: 86,800# is 1/4 the weight of 15-1/2 40' modules stacked vertically. (Total height of 69'-9" on top of bottom most module. SEE TR-006 NOTES FOR REVISION

7.0 REPORTING

7.1 Form TR-1073-AR-006 shall be used for all reporting of results of this test.

7.2 All final dimensions shall be recorded and reviewed by customer and LSI engineering.

7.3 Customer representative is required to witness this test.

Pressure Gauge	S/N 880988	Due 10-28-95	Last Cal. 10-28-94
Pressure Gauge	S/N 880999	Due 10-28-95	Last Cal. 10-28-9
50 FT. Starrett Tape	S/N WMQC-003	Due 7-11-99	Last Cal. 7-11-9
Pressure Gauge	S/N 880996	Due 10-28-95	Last Cal. 10-28-

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

DATE September 28, 1994

TR-1073-AR-006
CDRL A010

MODULE STACKING TEST

TEST REPORT

TR-1073-AR-006

CUSTOMER ATCOM

CUSTOMER CONTRACT DAAK01-93-D-0007

EQUIPMENT Causeway Ferry Pontoons

SHOP ORDER _____

TEST COMPLETION DATE 1 NOV 94

Record the following for each module:	Acceptable	Not Acceptable
Equipment is in current calibration.	yes	
Verify cylinder area of 11.045 in.^{2}	yes	

Module Serial Number P20 CR #004

Total Load Applied 9200 PSIG

Dimensional check results (see Reference 2.2, 2.3) and paragraph 6.3.

	Before		After		
	Rear	Side	Rear	Side	
Corner 1	52"	51"	52"	51"	Acceptable yes Not Acceptable _____

Notes TEST WEIGHT CHANGED TO 5 NON-POWDER + 3 POWDERED ISOPICS

OR [(36,000 + 23,260) x 3 + (22400 + 23260) x 5] ÷ 4 = 101,520/ CORNER = 9192 PSIG

Test Witnessed by:

LSI Rep Daryl Berry 11-1-94 Customer Rep _____ 1 NOV 94 Other _____

LSI Engineering Rep _____ 11/1/94

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

DATE September 28, 1994

TP-1073-AR-007
CDRL A010

MODULE FITTINGS TEST
TEST PROCEDURE

TP-1073-AR-007

CUSTOMER ATCOM

CUSTOMER JOB NO. N/A

CUSTOMER P.O. NO. DAAK01-93-D-0007

HULL NOS. N/A

EQUIPMENT All Causeway Ferry

EQUIPMENT NO. _____

EQUIPMENT SERIAL NO(S) _____

CUSTOMER NOTIFICATION PRIOR TO TESTING 2 Weeks

ENGINEERING NOTIFICATION PRIOR TO TESTING None

LAKE SHORE SALES ORDER NO. 1073AR

DRAWN W Keller DATE 9-30 94

CHECKED R M Shymanski DATE 9-30-94

APPROVED W Hall DATE 9-30-94

QUALITY ASSURANCE R Mattson DATE 10/3/94

REV.	DATE	APP'D BY	Q.A.	DESCRIPTION
A	OCT. 20, 1994	RMS	LSI 1 QA	REVISED TO INCORP NSWC CADEROCK DIV. COMMENTS RECEIVED OCT. 20, 1994
B	OCT 31, 1994	WJK	LSI 1 QA	ADDED ¶ C.2.6 AND C.3.6 TO REFLECT TEST METHOD. ADDED REQUIREMENTS FOR MAG PARTICLE TESTING

TP-1073-AR-007
CDRL A010

TEST PLAN
MODULE FITTINGS TEST

TP-1073-AR-007

1.0 PURPOSE

1.1 Purpose of this test is to demonstrate that each module deck cleat and tie down fitting design type meets the fitting test requirements of paragraph 4.5.2.5 of Reference 2.1.

2.0 REFERENCES

2.1 Purchase Description P.D. 1990-0098

3.0 EQUIPMENT REQUIRED

3.1 CFE.

The following Contractor Furnished Equipment (CFE) is required:

- Module restraint and pull test fixtures.
- One 20' Module
- Iron River Pull Test Facility
- Magnetic Particle Test Equipment

3.2 GFE.

None

4.0 INSPECTION CRITERIA

4.1 Following testing the fittings shall be inspected for the following defects:

- Any signs of permanent deformation or other abnormalities.
- Changes in dimensional requirements affecting fitting installation, securing or interchange.

5.0 ACCEPTANCE CRITERIA

5.1 Any permanent deformation resulting inability of the fitting to be removed and/or reinstalled shall be cause for rejection of the fittings.

TP-1073-AR-007
CDRL A010

6.0 PROCEDURE

6.1 Verify current calibration of test equipment.

6.2 Cargo Tiedown Pull Test

6.2.1 Place module with cargo tiedown in test area and secure.

6.2.1.1 Check welds by magnetic particle method

6.2.2 Test load 30,000# tensile pull. 30,000 #/11.015 = 2717 PSIG FOR THIS TEST.

6.2.3 Load sequentially around the fitting at 45° intervals in a horizontal plane (8 pulls).

6.2.4 Load at 45° above and below a horizontal plane normal to the side shell plane (2 pulls).

6.2.5 Apply loads for 10 minutes at each location.

6.2.6 Relocate fittings as required to allow for all pull angles.

6.2.7 Following all pull tests recheck welds by magnetic particle method.

6.3 Deck Cleat Pull Test

6.3.1 With module secure in test area, install one deck cleat fitting.

6.3.1.1 Check welds by magnetic particle method

6.3.2 Test load 30,000# tensile pull.

6.3.3 Load sequentially around the fitting at 45° intervals in a horizontal plane (8 pulls).

6.3.4 Load at 45° above and below a horizontal plane normal to the side shell plane (2 pulls).

6.3.5 Apply loads for 10 minutes at each location.

6.3.6 Relocate fittings as required to allow for all pull angles.

6.3.7 Following all pull tests recheck welds by magnetic particle method.

TP-1073-AR-007
CDRL A010

7.0 REPORTING

7.1 Form TR-1073-AR-007 shall be used for all reporting of results of this test.

7.2 Customer representative is required to witness this test.

	CALDUE	LAST CAL
BRIDGE AMP S/N 884008	7-29-95	7-29-94
STOP WATCH S/N 881043	10-28-95	10-28-94

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

DATE September 28, 1994
REVISED October 31, 1994

TR-1073-AR-007
CDRL A010

MODULE FITTINGS TEST

TEST REPORT

TR-1073-AR-007

CUSTOMER ATCOM

CUSTOMER CONTRACT DAAK01-93-D-0007

EQUIPMENT Causeway Ferry Pontoons

PONTOON SERIAL NO. PZOL #001

SHOP ORDER _____

TEST COMPLETION DATE 3 Nov 94

Record the following for each fitting:	Acceptable	Not Acceptable
Calibration of equipment is current.	YES	

Deck cleat loading

	Horizontal Pull	Load Applied	Time	Deck Cleat Removable Acc	Not Acc
	Magnetic Particle Inspection			YES	
#1	Pull 1	30,000#	10 min.	YES	
#3	Pull 2	30,000#	10 min.	YES	
#8	Pull 3	30,000#	10 min	YES	
#10	Pull 4	30,000#	10 min.	YES	
#12	Pull 5	30,000#	10 min	YES	
#14	Pull 6	30,000#	10 min	YES	
#17	Pull 7	30,000#	10 min	YES	
#19	Pull 8	30,000#	10 min	YES	

TR-1073-AR-007
CDRL A010

	Load Applied	Time	Tiedown fitting Removable Acc	Not Acc
#6 45° Above Horz (Normal to side)	30,000#	10 min	YES	
#7 45° Below Horz (Normal to side)	30,000#	10 min	YES	
Magnetic Particle Inspection			YES	

Tie down fitting loading

Horizontal Pull	Load Applied	Time	Tiedown fitting Removable Acc	Not Acc
Magnetic Particle Inspection			YES	
#2 Pull 1	30,000#	10 min.	YES	
#4 Pull 2	30,000#	10 min.	YES	
#9 Pull 3	30,000#	10 min.	YES	
#11 Pull 4	30,000#	10 min.	YES	
#13 Pull 5	30,000#	10 min	YES	
#15 Pull 6	30,000#	10 min.	YES	
#16 Pull 7	30,000#	10 min.	YES	
#18 Pull 8	30,000#	10 min.	YES	
#5 45° Above Horz	* 30,000#	10 min.	YES	
#21 (Normal to side)	Retest 30,000#	10 min	YES	
#20 45° Below Horz (Normal to side)	30,000#	10 min	YES	
Magnetic Particle Inspection			YES	

LSI 03111

* Rope clamp interference with sheave during applied load - Retest.

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

SHEET 7 OF 7
DATE September 28, 1994
REVISED October 31, 1994

TR-1073-AR-007
CDRL A010

Notes ____

____

Test Witnessed by:

LSI Rep Nancy Porier 11-03-94 Customer Rep Donald R. Bracy 11-03-94 Other ______________

LSI Engineering Rep [signature] 11-3-94

LSI 03112

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MI

DATE October 14, 1994

TP-1073-AR-008
CDRL A010

MODULAR CAUSEWAY FERRY ASSEMBLY LIFTING TEST PROCEDURE

TP-1073-AR-008

CUSTOMER ATCOM

CUSTOMER JOB NO. N/A

CUSTOMER P.O. NO. DAAK01-93-D0007

HULL NOS. First Article

EQUIPMENT Spreader Assembly

EQUIPMENT NO. E19883

EQUIPMENT SERIAL NOS. ______

CUSTOMER NOTIFICATION PRIOR TO TESTING 7 DAYS

ENGINEERING NOTIFICATION PRIOR TO TESTING 14 DAYS

LAKE SHORE SALES ORDER NO. 1073AR

DRAWN [signature] DATE OCT 14, 1994

CHECKED Rick [signature] DATE OCT 18 1994

APPROVED William J Keller DATE Oct 19, 1994

QUALITY Keith Mattson DATE 10/19/94

LSI 02993

TP-1073-AR-008
CDRL A010

Rev	Date	Appvl	Q.A.	Description
--	10/21/94	WJK	LSI 1 QA	Initial Issue
A	1/13/95	WJK	LSI 1 QA	Revised entire procedure to reflect new test method
B	1/17/95	WJK	LSI 1 QA	Revised TP and to change from dye penetrant testing

TP-1073-AR-008
CDRL A010

MODULAR CAUSEWAY FERRY ASSEMBLY LIFTING TEST PROCEDURE

TP-1073-AR-008

1.0 INTRODUCTION

1.1 Objective. The objective of the Assembly Lifting Test is to verify the ability of the spreader bar, slings, shackles, and lifting rings have sufficient capacity and safety factor to lift the Modular Causeway Ferry (MCF) Powered Section without deformation or failure. Testing shall demonstrate that the Lifting Assembly will lift a design load of 2.3 times the weight of the Powered Section (2.3 x rated static load).

1.2 Test Item. The test item, described as the Spreader Assembly is defined by Lake Shore drawing E19883.

1.3 Test Limitations. Assembly Lifting Tests will be conducted on the individual parts of the Spreader Assembly in lieu of testing the completed assembly. Lifting Rings and shackles (integral parts of the module) are tested in accordance with Lake Shore test procedure TP-1073-AR-001; shackles and assembled slings will be certified to the specified load by the manufacture; the spreader bar will be tested at a Lake Shore test facility as specified herein.

2.0 REFERENCE DOCUMENTS

2.1	PD 1990-0098	Purchase Description (Para's 4.5.2.6, 3.5.25)
2.2	Mil-Std-209H	Slinging and Tiedown Provisions for Lifting and Tying Down Military Equipment
2.3	E20001	General Test Requirements
2.4	E20011	Failure Reporting, Analysis, and Corrective Action System (FRACAS)
2.5	E19983	Instrumentation, Assembly Lifting Test

3.0 TEST PREPARATION

3.1 Approach to Test. Assembly Lifting Tests will be conducted on the individual parts of the Spreader Assembly in lieu of testing the completed assembly. Lifting Rings and shackles (integral parts of the module) are tested in accordance with Lake Shore test procedure TP-1073-AR-001; shackles and assembled slings will be certified to the specified load by the manufacture.

The spreader bar is rated at 100 ton lift capacity. To verify the strength of the lifting eyes, each eye will be individually tested to its rating; the crane hook eye (top of beam) will be tested to 2.3 x 100 ton, the two sling hook eyes (bottom of beam) will be tested to 2.3 x 50 ton. The strength of the beam in bending will be verified by calculation.

3.2 General Test Requirements. Refer to the following documents for general test requirements:

E20001 General Test Requirements; location and schedule of test, calibration requirements, safety requirements, and general test documentation.

E20011 Failure Reporting, Analysis, and Corrective Action System (FRACAS).

3.3 Government Notification. ATCOM and Government Quality Assurance Representative shall be provided with seven (7) days notification prior to the start of testing.

3.4 Personnel Requirements. The following personnel are required for performance of the Assembly Lifting Test:

3.4.1 Contractor furnished personnel: Test supervisor, test equipment technicians.

3.4.2 Government furnished personnel: None.

3.5 Facilities and Test Equipment. The following facilities, support equipment, and test equipment are required for performance of the Assembly Lifting Test (CFE = Contractor furnished equipment, GFE = Government/Customer furnished equipment):

	CFE	GFE
3.5.1 One (1) Spreader Assembly, E19883;	X	
3.5.2 Instrumentation and load application fixtures, E19983;	X	

3.6 The instrumentation for applying and measuring spreader bar loads shall be installed as documented in Lake Shore drawing E19983.

4.0 TEST PROCEDURE

4.1 Clean welds as indicated on sketch 4.0-1 "NDT Inspection, Proof Test" for dye penetrant inspection.

(B) 4.2 Perform magnetic particle inspection of weld areas indicated in Sketch 4.0-1 prior to testing.

4.3 Assemble test set-up for crane eye test per Reference 2.4.

4.4 Slowly apply pressure to cylinders until load of 230 short tons is applied.

4.4.1 A 230 ton load is based on the following formula:

Cylinder Area x Pressure = Load

For Enerpac CLL 1506 Cylinders this becomes:

2 ea x 30.69 $in.^2$ x P = 460,000#

or

P = 460,000/2 x 30.69

thus

P = 7494 PSI

4.4.2 ***APPLY NO MORE THAN 8250 PSI*** !

4.5 Hold applied load 90 seconds.

4.6 Following removal of load visually inspect all welds and beam for deformation or cracks.

4.7 Rig beams per Reference 2.4 for sling hook eye pull.

4.8 Apply the 7494 psi load per 4.4.1 above.

4.8.1 ***DO NOT EXCEED 8250 PSI*** !

4.9 Hold the load for 90 seconds.

4.10 Following release of load visually inspect the beam and all welds for deformation or cracks.

(B) 4.11 Perform magnetic particle inspections of specific welds per Figure 4.0-1 following all pull test load applications.

5.0 ACCEPTANCE CRITERIA.

Acceptance criteria for the Assembly Lift Test is as follows:

5.1 All purchased lift items have proper certification.

5.2 The spreader bar, hook eyes and pads show no signs of permanent deflection or weld failure.

6.0 REPORTING

Report data on Form TR-1073-AR-008.

7.0 MARKING OF BEAM

Following successful proof loading of each beam stamp the following on the top flange of the beam.

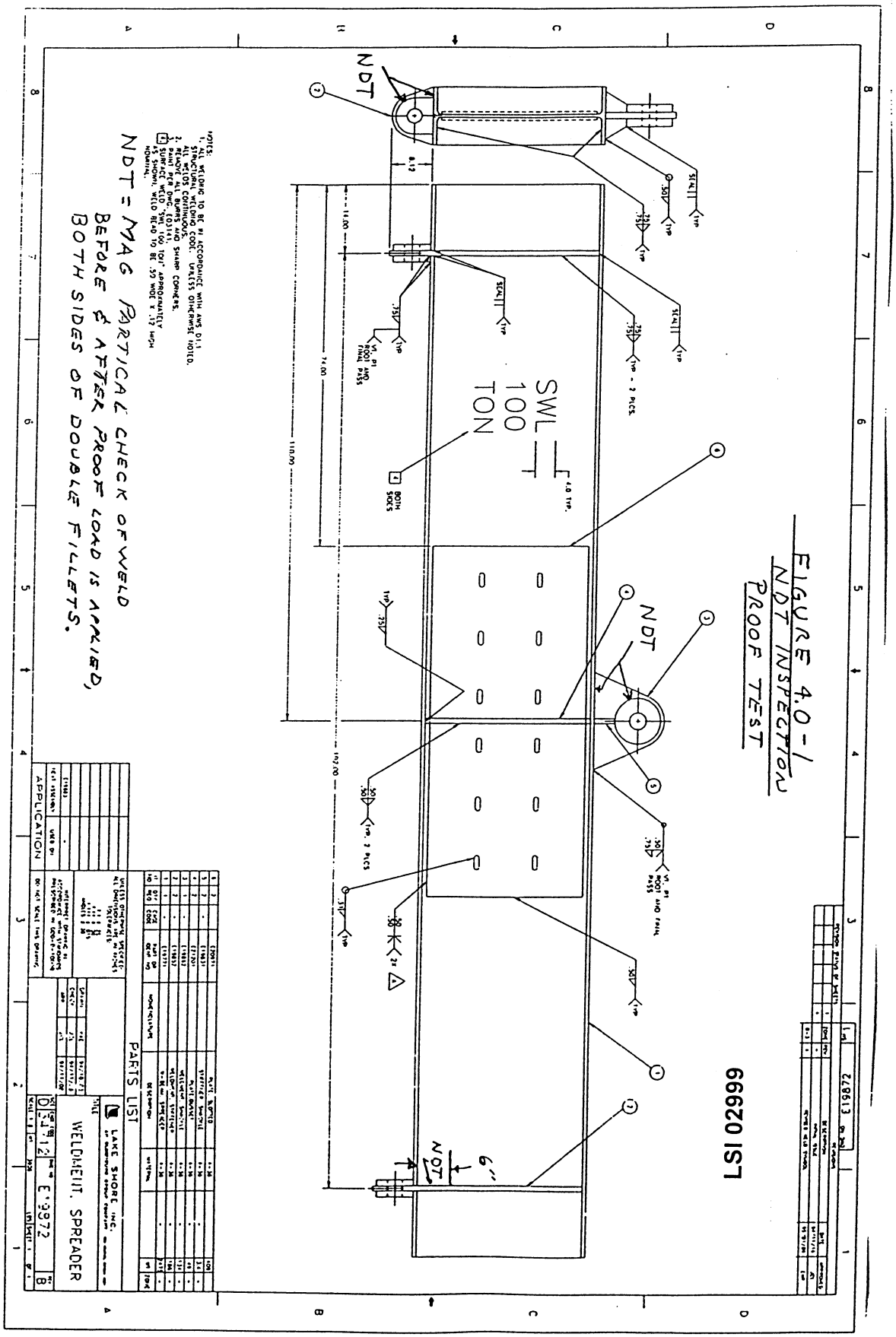
7.1 Date of proof load, "P.L. MO/DAY/YEAR"

7.2 Serial Number of Beam, "E19883 SN X"

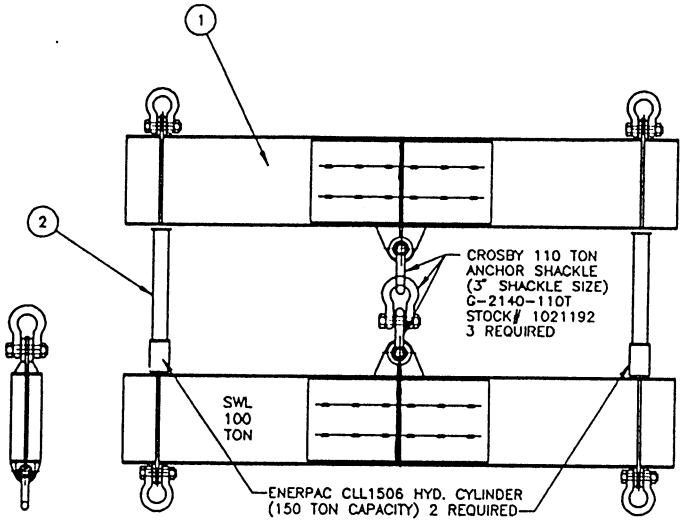
7.2.1 X is consecutively numbered starting at 1.

TP-1073-AR-008
CDRL A010

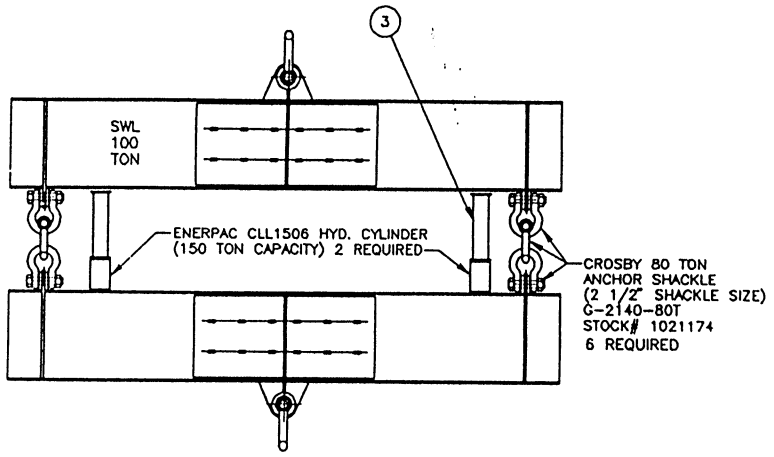
FIGURE 4.0-1 NDT INSPECTION PROOF TEST (A)



REVISION STATUS OF SHEETS						REVISIONS			
						REV	DESCRIPTION	DATE	APPROVED
						-	INITIAL ISSUE	94/01/17	EWR



SINGLE PADEYE LOAD TEST



OUTBOARD PADEYE LOAD TEST

NOTES:
1. CENTER SPACERS AND HYD. CYLINDERS DIRECTLY OVER BEAM WEB.

IT NO	QTY REQ	CAGE CODE	PART OR IDENT NO	NOMENCLATURE	DESCRIPTION	MATERIAL	WT	ZONE
3	2	-	E21962	-	SPACER,27.0"	STL	-	-
2	2	-	E21972	-	SPACER,45.5"	STL	-	-
1	2	-	E19872	-	WELDMENT,SPREADER	STL	-	-

PARTS LIST

E09262	-
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
X.X ± .06
X.XX ± .03
X.XXX ± .015
ANGLES ± 1° 30'

INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS PRESCRIBED IN DOD-D-10008

DO NOT SCALE THIS DRAWING

DRAWN	EWR	95/01/16
CHECK	ELB	95/01/16
APP	RAS	95/01/17

LAKE SHORE INC.
AN OLDENBURG GROUP COMPANY IRON MOUNTAIN, MI 49801

TITLE
MCF LIFT BEAM LOAD TEST

SIZE	CAGE CODE	DWG NO	REV
C	34712	E19983	

SCALE 1/1 | WT .18 LBS | SHEET 1 OF 1

DWG NO E19983 SH 1

LSI 03000

TR-1073-AR-08
CDRL A010

MODULAR CAUSEWAY FERRY ASSEMBLY LIFTING TEST TEST REPORT

TR-1073-AR-008

CUSTOMER ATCOM

CUSTOMER P.O. NO. DAAK01-93-D-0007

EQUIPMENT LIFTING ASSEMBLY - E19883

EQUIPMENT SER NO. E19883 S/N 001, 002

SHOP ORDER _____

TEST COMPLETION DATE 20 JAN 95

TEST DATA

- Test performed at LSI IRON RIVER Facility.

	Acceptable	Not Acceptable
• Visual inspection of welds and beam (use "NOTES" below to report discrepancies.	✓	
(B) • Magnetic particle of specified welds (use "NOTES" below to report discrepancies).	✓	
• Hydraulic unit gauges in current calibration. #1880998 CAL 10-28-94 DUE 10-28-95	✓	
• Test assembly is rigged correctly for crane eye test.	✓	
• Test Load applied to crane eye correctly. PSI 7500	✓	
Load 460,000#	✓	
• 8250 PSI not exceeded.	✓	

STOP WATCH ~~#881044 CAL DUE 9-14-95~~ MP.
#881043 CAL DUE 10-28-95

TR-1073-AR-08
CDRL A010

	Acceptable	Not Acceptable
• Visual examination results (use "NOTES" below to report discrepancies).	✓	
• Test assembly is rigged correctly for sling eye test.	✓	
• Sling eye test load is applied correctly.		
PSI 7500	✓	
Load 460,000 #	✓	
• 8250 PSI not exceeded.	✓	
• Visual examination results (use "NOTES" below to report discrepancies).	✓	
(B) • Magnetic particle check results (use "NOTES" below to report discrepancies).	✓	
• Unit(s) is (are) correctly stamped.	✓	
• Vendor data for purchased lift items is correct and complete. Bridle Sling	✓	

NOTES (Vendor Shackles proof load tested as part of the test - Shackles used for testing only were not used as a "shipped item" NP).

Test Witnessed by:

LSI Rep Nancy Porier **Customer Rep** Howard R. Beal **Other** _____

SECTION QAP 17.5
PAGE NO. 1 of 1
REV. NO. 1
DATE OF ISSUE 03-20-91

TR-1073-AR-008

PRE-TEST INSPECTION

MAGNETIC PARTICLE INSPECTION REPORT

OPERATION 20

Lake Shore Inc. Date 11/20/95

Job No. ARV096 Lift Beam Load Test

Customer's P.O. No. DAAK01-93-D0007

Drawing No. E19983 (SPREADER WELDMENT #E19872)

Serial No. N/A Heat lot Number N/A

(E001 & E002 TO BE STAMPED)

1. Magnetic Particle Specification or Procedure No. QAP 17.5
2. Magnetic Particle Method _____ Wet X Dry
3. Surface Preparation _____ Machined X Rough
4. Equipment _____ Portable Prods _____ Stationary Equipment X Yoke
5. Date Equipment Calibrated 1/2/95
6. Bath Strength _____ 1.2 to 2.4 ML (Visible) _____ 0.1 to 7 ML (flourescent)
7. Magnetic Field X Longitudinal _____ Circular
8. Apply Particles X Continuous _____ Residual
9. Determining Amperage for longitudinal 6AMP AC YOKE

   For Circular _____
10. Product Spacing 2"-8" Acceptance Standard 2"-8".
11. Interpretation NO RECORDABLE INDICATIONS FOUND
12. Accepted 2
    Rejected 0
    Tested 2

Inspector Rick Dewberry
Level II
Date of Recertification 9/96

LSI 03003

TR-1073-AR-008

Post-test Inspection

MAGNETIC PARTICLE INSPECTION REPORT

Operation 40

Lake Shore Inc. Date 1/20/95

Job No. ARV096 Lift Beam Load Test

Customer's P.O. No. DAAK01-93-D0007

Drawing No. E19983 (spreader weldment E19872)

Serial No. N/A Heat lot Number N/A

E19883-S/N001
E19883-S/N002

1. Magnetic Particle Specification or Procedure No. QAP 17.5
2. Magnetic Particle Method _____ Wet X Dry
3. Surface Preparation _____ Machined X Rough
4. Equipment _____ Portable Prods _____ Stationary Equipment X Yoke
5. Date Equipment Calibrated 1/3/95
6. Bath Strength _____ 1.2 to 2.4 ML (Visible) _____ 0.1 to 7 ML (flourescent)
7. Magnetic Field Y Longitudinal _____ Circular
8. Apply Particles X Continuous _____ Residual
9. Determining Amperage for longitudinal Lamp AC Yoke

   For Circular

10. Product Spacing 2"-8" Acceptance Standard 2"-8".
11. Interpretation NO Recordable Indications FOUND
12. Accepted 2
    Rejected 0
    Tested 2

Inspector [signature]
Level II
Date of Recertification 9/96

LSI 03004

TR-1073-AR-008

E20988
Bridle Sling

ALABAMA SLING CENTER

Certificate of Conformance

This is to certify that the wire rope slings/assemblies have been tested and conform to the information contained herein:

Sold to: LAKE SHORE INC.
MANUFACTURE DIVISION
IRON MOUNTAIN, MI 49801

M. O. # 04261435

Shipped to: LAKE SHORE INC.
921 RIVER STREET
ONTONAGON, MI 49953

Customer Order # 109590

Material Description 6 x 36 XIP IWRC

Customer Part #

Reel Number 38401687 & 02540537

Material broken at N/A pounds.

Sling/Assembly Description (2) WRS-125-HT-HT 2 1/4" x 17'

Sling/Assembly proofloaded to 176,000 pounds in a straight pull.

WARRANTY

Any warranty, expressed or implied as to quality, performance, or fitness for use is always premised on the condition that the published rated capacities apply only to new, unused slings and assemblies, that the mechanical equipment on which such products are used is properly designed and maintained, that such products are properly stored, handled, used, and maintained, and properly inspected on a regular basis during the period of use.

Alabama Sling Center P.O. Box 203 Dolomite, AL 35061

Signed Ralph E. Smith Jr. Title GENERAL MANAGER

Date 1/16/95

LSI 03005

LAKE SHORE INC.

AN OLDENBURG GROUP COMPANY
IRON MOUNTAIN, MICHIGAN 49801
(906) 774-1500 FAX (906) 774-1505

PURCHASE ORDER

P/O NUMBER	PAGE
109590-00	01

P/O DATE	CHANGE/CANCEL
12/20/1994	

ORDER AND SEPARATE INVOICES IN TRIPLICATE FOR EACH ORDER
PLEASE MAIL ALL CORRESPONDENCE, AND ACKNOWLEDGEMENT
TO: P.O. BOX 809, IRON MOUNTAIN, MICHIGAN 49801

ORDER NUMBER MUST BE SHOWN ON ALL SHIPMENTS, SHIPPING PAPERS, INVOICES AND CORRESPONDENCE.

(Ship to the above address unless specified below.)

ORDERED FROM
WIRE ROPE
609 N. SECOND STREET
P.O. BOX 288
ST. JOSEPH, MO 64502

SHIP TO
LAKE SHORE INC
921 RIVER STREET
ONTONAGON MI 49953

ORDER TYPE	BUYER	ACKNOW-LEDGE	CONFIRM	TERMS	F.O.B.	SHIP VIA	COL/PP
NORMAL	JODY BIGALKE	YES	YES	NET 45 DAY	SHIPPING	SEE ATTACHED	COL

LINE NUMBER	QUANTITY ORDERED / BLANKET TYPE	U/M	OUR ITEM NUMBER / DESCRIPTION/NOTES	YOUR ITEM NUMBER	PRICE/UNIT	REQUESTED DATE	CHANGE/ CANCEL
01	2	EA	E20988 DWG REV: NO SLING,BRIDLE,COMPLETE TO DWG UP RIGGERS & TOOL SUPPLY* DWG REV: NO THE FOLLOWING PQR'S ARE INVOKED PER LSI QAF 6.2 DELIVERABLE (DELV) NON-DELIVERABLE (NON-DELV) 118 PRESERV PKG/SHP (NON-DELV) **JOB ARM042** GOV'T CONTRACT #: DAAK01-93-D-0007 GOV'T PRIORITY RATING: DO-C9 SPECIFICATIONS AND STANDARDS. UNLESS OTHERWISE SPECIFIED, THE FOLLOWING SPECIFICATIONS AND STANDARDS OF THE ISSUE LISTED IN THAT ISSUE OF THE DEPTARTMENT OF DEFENSE INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) DATED 91JULY01 WITH SUPPLEMENT 01MAY92 AS SPECIFIED IN THE SOLICITATION, FORM A PART OF THIS PURCHASE ORDER TO THE EXTENT SPECIFIED HEREIN. CONFIRMING TO KATHY ON 12-19-94 BY AUTHORIZED ACKNOWLEDGEMENT OF		2,240.640	01/20/1995	

1-9-95 - Vendor waiting for end fitting from their supplier. Ship by 1-12 after receipt - ship 2 days late

1-18 shipped 1-16 via CF will fax info to today

PLEASE ACKNOWLEDGE RECEIPT AND ACCEPTANCE OF THIS ORDER BY SIGNING AND RETURNING TO US IMMEDIATELY THE ATTACHED ACKNOWLEDGEMENT COPY.

SHIPPING INSTRUCTION MUST BE FOLLOWED.

PURCHASING

3. THIS ORDER REPRESENTS AN OFFER TO PURCHASE THE GOODS DESCRIBED HEREIN SUBJECT TO THE TERMS AND CONDITIONS ON THIS AND THE REVERSE SIDES OF THIS ORDER AND ANY ATTACHEMENTS HERETO, AND ACCEPTANCE OF THIS ORDER IS LIMITED TO THOSE TERMS AND CONDITIONS.

TAX STATUS - LICENSE K38-0740937 Taxable ..... Not Taxable .....

1. Ind. Processing 2. RES/ Reason ..... 3. Other

LSI 03006

AUTHORIZED PURCHASING AGENT _____

(attachment to test procedures/reports)

EQUIPMENT Modular Causeway Ferry (MCF)

JOB NUMBER 1073 AR

SERIAL NUMBER Hull # 1

TR-1073-AR-009 Section Frogboard

This test report/procedure has been reviewed and is properly signed off. All data blanks and tables are filled in.

Q.C. INSPECTOR Earl W. Parker

DATE June 7, 1995

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MICHIGAN

DATE October 18, 1994
REVISED May 3, 1995

TP-1073-AR-009
CDRL A010

MODULAR CAUSEWAY FERRY
SECTION FREEBOARD
TEST PROCEDURE

TP-1073-AR-009

CUSTOMER ATCOM

CUSTOMER JOB NO. N/A

CUSTOMER P.O. NO. DAAK01-93-D0007

HULL NOS. First Article

EQUIPMENT Modular Causeway Ferry

EQUIPMENT NO. E03155

EQUIPMENT SERIAL NOS. P40P-0001, P40P-0002 (Powered Modules)

CUSTOMER NOTIFICATION PRIOR TO TESTING 7 DAYS

ENGINEERING NOTIFICATION PRIOR TO TESTING 14 DAYS

LAKE SHORE SALES ORDER NO. 1073AR

DRAWN John C Lovell DATE Oct 18, 1994

CHECKED Rick Szymanski DATE OCT 18 1994

APPROVED William J Keller DATE 10-19-94

QUALITY Kirk Swanson DATE 10/19/94

TP-1073-AR-009
CDRL A010

Rev	Date	Appvl	Q.A.	Description
-	10/21/94		LSI 1 QA	Initial Issue
A	1-26-95	WJK	LSI 1 QA	Revised procedure throughtout to reflect final test configuration.
B	5/3/95	WJK	K. Uran	Revised procedure to measure freeboard overboard with modules in water. Added second intermediate section. Revised TR-1073-AR-009 to suit.

TP-1073-AR-009
CDRL A010

MODULAR CAUSEWAY FERRY
SECTION FREEBOARD TEST PROCEDURE
TP-1073-AR-009

1.0 INTRODUCTION

1.1 Objective. The objective of the Section Freeboard Test is to verify that each section of the Modular Causeway Ferry (MCF) (Powered Section, Intermediate Section, Beach/Sea End Section) meets the freeboard requirements specified to assure interoperability with MCS and NL Section designs. Testing shall demonstrate that each section of the MCF will have a lightship freeboard of 40 $\pm$2 inches and a rated load freeboard of not less than 12 inches.

1.2 Test Item. The test item, described as the MCF, is defined by Lake Shore drawing E03155 and includes one Powered Section (E19203), two Intermediate Sections (E19193), and one Beach/Sea End Section (E19183).

1.3 Test Limitations. Section Freeboard Testing will be performed with the sections in water. To obtain the most accurate freeboard measurements, the water must be dead calm. For water that is other than dead calm, subjective readings to determine the average freeboard will be made.

2.0 REFERENCE DOCUMENTS

2.1	PD 1990-0098	Purchase Description (Para's 4.5.2.7.1, 3.5.22.1, 3.5.22.2)
2.2	E20001	General Test Requirements
2.3	E20011	Failure Reporting, Analysis, and Corrective Action System (FRACAS)

3.0 TEST PREPARATION

3.1 Approach to Test. The freeboard of each section of the MCF will be determined by direct measurement at each corner of each section. Freeboard will be determined for both the lightship and fully loaded conditions.

3.2 General Test Requirements. Refer to Ref 2.2 and 2.3 general test requirements:

3.3 Government Notification. The ATCOM and Government Quality Assurance Representative shall be provided with seven (7) days notification prior to the start of testing.

3.4 Personnel Requirements. The following personnel are required for performance of the Section Freeboard Test:

3.4.1 Contractor Furnished Personnel: Test supervisor, Test assistant.

3.4.2 Government Furnished Personnel: Dock side personnel for mooring, fueling, and rigging and handling the MCF load.

3.5 Facilities and Test Equipment. The following facilities, support equipment, and test equipment are required for performance of the Section Freeboard Test (CFE = Contractor furnished equipment, GFE = Government/Customer furnished equipment):

		CFE	GFE
3.5.1	One (1) complete MCF Powered Section, outfitted for duty, two (2) complete MCF Intermediate Sections, one (1) complete MCF Beach/Sea End Section	X	
3.5.2	350 short tons of load with rigging for handling the load.		X
3.5.3	Diesel fuel oil, ASTM D975 Grade 2-D or equal, 800 gallons.		X
3.5.4	Mooring lines and dockside equipment for mooring the MCF to the pier.		X

4.0 TEST PROCEDURE

4.1 Section Freeboard Testing will be performed after each section is assembled, and prior to connecting the sections into the 320 foot MCF configuration. Test data shall be recorded on the Test Report TR-1073-AR-009.

4.2 For each section, measure and record the freeboard at each corner in the lightship condition.

4.3 For each section, measure and record the freeboard at each corner in the full load condition. Full load is defined as 100 short tons of cargo for the Intermediate and Beach/Sea End Sections and 50 short tons of cargo for the Powered Section, and 800 gallons of fuel on board. The load shall be distributed evenly on the deck of the sections.

4.4 For each section, calculate the mean freeboard for the lightship and full load conditions.

5.0 ACCEPTANCE CRITERIA

5.1 Acceptance criteria is as follows:

Lightship condition - Freeboard = 40 $\pm$2 inches to accept

Full load condition - Freeboard = 12 inches minimum to accept

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MICHIGAN

DATE October 18, 1994
REVISED May 3, 1995

TR-1073-AR-009
CDRL A010

MODULAR CAUSEWAY FERRY
SECTION FREEBOARD TEST

TEST REPORT

TR-1073-AR-009

CUSTOMER ATCOM

CUSTOMER P.O. NO. DAAK01-93-D-0007

EQUIPMENT MODULAR CAUSEWAY FERRY

DATE OF MEASUREMENTS LIGHTSHIP 5/8/95 FULL LOAD 5/11/95 & 5/12/95

LOCATION FORT EUSTIS.

DRAFT MARKS APPLIED PROPERLY Acc ✓ Not Acc ____

MEASURED FREEBOARD - LIGHTSHIP

SECTION	PORT FWD	PORT AFT	STBD FWD	STBD AFT	MEAN (¶ 3.1)	ACCEPTABLE	NOT ACCEPTABLE
Powered	33.0	32.0	30.5	29.75	31.31	—	—
Intermediate #1	36.5	37.5	36.5	37.5	37.0		✓
Intermediate #2	36.75	37.38	36.5	37.25	36.97		✓
Beach/Sea	39.75	36.0	40.0	35.75	37.88		✓

MEASURED FREEBOARD - FULL LOAD

SECTION	PORT FWD	PORT AFT	STBD FWD	STBD AFT	MEAN (¶ 3.1)	ACCEPTABLE	NOT ACCEPTABLE
Powered	—	—	—	—	—		
Intermediate #1	14.5	17.01	13.5	15.5	15.13	✓	
Intermediate #2	15.0	13.0	15.0	13.0	14.0	✓	
Beach/Sea	21.0	17.0	19.5	15.0	18.13	✓	

NOTES: Lightship measured on May 8, 1995
Full Load Measured on May 11, 1995 + May 12, 1995
NO FREEBOARD REQUIREMENTS REQUIRED IN POWERED SECTION.

Test Witnessed by:

LSI Rep [signature] Customer Rep [signature] Other ____

FAILURE IDENTIFICATION REPORT

Failure Date MAY 8, 1995 Failure No. TP- 1073-AR-009 -FI 01

LSI Job No. _____ Customer Contract No. DAAK01-93-D0007

	Name	Part No.	Serial No.
Equipment	MODULAR CAUSEWAY FERRY		#1
Subassembly	NON POWERED SECTIONS		
Failed Part	FREEBOARD		

1. Test Failed / Paragraph:

TP 1073-AR-009 P 5.1

2. Total Test Time at Failure: _____ hrs _____ cycles

N/A

3. Description of Failure / Symptoms: Photograph Y (N)

MEASURED MEAN FREEBOARD ARE LESS THAN THE 40"-2" AS REQUIRED, FOR LIGHT SHIP CONDITION

4. Other Equipment Failed or Affected:

NONE

5. Repair Action:

NO REPAIR ACTION. MODULE WEIGHTS PER TP AR-1073-002 ARE WITHIN P.D. LIMITS AND ARE SIMILAR TO EXISTING G.F.E. REQUEST WAIVER FOR 38" FREEBOARD REQUIREMENT.

Engineering Contact: E. RAMLOW

6. LSI Test Supervisor: W KELLER WK Date JUN X 5 1995

Submit to Engineering for Failure Analysis

LSI 03225

SIZE	CODE IDENT. NO.	DRAWING NO.	REV.
A	34712	E20011	A
SCALE		SHEET	3 of 3

GMB 561649

(attachment to test procedures/reports)

EQUIPMENT Moolar Causeway Ferry (MCF)

JOB NUMBER 1073 AR

SERIAL NUMBER Hull # 1

TR-1073-AR-017 EMI/EMC

This test report/procedure has been reviewed and is properly signed off. All data blanks and tables are filled in.

Q.C. INSPECTOR Earl W. Taylor

DATE June 7, 1995

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MICHIGAN

DATE October 19, 1994

TP-1073-AR-017
CDRL A010

MODULAR CAUSEWAY FERRY
EMI/EMC TEST
TEST PROCEDURE

TP-1073-AR-017

CUSTOMER ATCOM

CUSTOMER JOB NO. N/A

CUSTOMER P.O. NO. DAAK01-93-D0007

HULL NOS. First Article

EQUIPMENT Modular Causeway Ferry

EQUIPMENT NO. E03155

EQUIPMENT SERIAL NOS. P40P-0001, P40P-0002 (Powered Modules)

CUSTOMER NOTIFICATION PRIOR TO TESTING 7 DAYS

ENGINEERING NOTIFICATION PRIOR TO TESTING 14 DAYS

LAKE SHORE SALES ORDER NO. 1073AR

DRAWN P J JACOBS DATE OCT 17, 1994

CHECKED Rich Kalo DATE Oct 19, 1994

APPROVED William J Keller DATE Oct 19 1994

QUALITY Keith Matson DATE 10/19/94

TP-1073-AR-017
CDRL A010

Rev	Date	Appvl	Q.A.	Description
--	10/21/94	WJK	LSI 1 QA	Initial Issue

TP-1073-AR-017
CDRL A010

MODULAR CAUSEWAY FERRY
EMI/EMC TEST PROCEDURE

TP-1073-AR-017

1.0 INTRODUCTION

1.1 Objective. This test will demonstrate the absence of Electromagnetic Interference (EMI) aboard MCF, and Electromagnetic Compatibility (EMC) of electrical and electronic systems installed on MCF. EMI/EMC performance of the MCF shall be in accordance with requirements of Purchase Description, Paragraph 3.5.14.

1.2 Test Item. The test item, described as the MCF, is defined by Lake Shore drawing E03155.

1.3 Test Limitations. Phase I of EMI/EMC Testing will be performed dockside during vehicle offload test. Phase II of the EMI/EMC test will be conducted while underway in a typical operating condition, and will be performed in conjunction with centralized propulsion control and maneuvering trials. Coordination of Phase II testing with other underway testing is the responsibility of the contractor and will be done prior to getting underway.

1.4 Special Conditions. Performance of Phase II will require Government authorization to transmit on VHF-FM marine channels, and DOD tactical frequencies.

2.0 REFERENCE DOCUMENTS

2.1	PD 1990-0098	Purchase Description (Para's 4.5.2.7.8, 3.5.14)
2.2	E20001	General Test Requirements
2.3	E20011	Failure Reporting, Analysis, and Corrective Action System (FRACAS)
2.4	MIL-STD-1605	Procedures for Conducting a Shipboard Electromagnetic Interference (EMI) Survey (Surface Ships)

3.0 TEST PREPARATION

3.1 Approach to Test. Phase I of the MCF EMI/EMC test will determine if there are any potential sources of EMI in the electrical system. Phase II of the EMI/EMC test will check all MCF electronic and electrical systems in a systematic manner to ensure Electromagnetic Compatibility in all operating conditions.

3.2 General Test Requirements. Refer to the following documents for general test requirements:

E20001 General Test Requirements; location and schedule of test, calibration requirements, safety requirements, and general test documentation.

E20011 Failure Reporting, Analysis, and Corrective Action System (FRACAS).

3.3 Government Notification. ATCOM and the Government Quality Assurance Representative shall be provided with seven (7) days notification prior to the start of testing.

3.4 Personnel Requirements. The following personnel are required for performance of the EMI/EMC Test:

3.4.1 Contractor personnel: Test supervisor, MCF operators, MCF crew (Phase II), test equipment technicians.

3.4.2 Government personnel: Dock side personnel for mooring, fueling, and rigging and handling the MCF load (Phase II).

3.5 Facilities and Test Equipment: The following facilities, support equipment, and test equipment are required for performance of the EMI/EMC Test (CFE = Contractor furnished equipment, GFE = Government/Customer furnished equipment):

	CFE	GFE
3.5.1 One (1) complete MCF, outfitted for duty.	X	
3.5.2 RF interference measuring equipment (150 Khz to 25 Mhz), Stoddart NM-25T, Stoddart NM-20 (AN/PRM-1) or equivalent with whip and probe antennas.	X	
3.5.3 SINCGARS, AN/VRC-90A, Radio set.		X
3.5.4 Authorization to transmit on VHF-FM marine channels and DOD tactical frequencies.		X

4.0 TEST PROCEDURE

4.1 Test shall be performed in accordance with MIL-STD-1605(SHIPS). Refer to MIL-STD-1605 paragraphs 5.1 through 5.2.7 for detailed requirements.

4.2 Verify Government authorization to transmit on VHF-FM marine channels and DOD tactical frequencies is secured.

4.3 During Phase I, preliminary survey, check all electrical equipment in the operator's cab, on the weather deck, and in one power module for emission of EMI at 150 KHz. Any sources of broadband EMI shall be rechecked at 2 MHz. Sources of emissions which exceed the limits of figure 1 of MIL-STD-1605 shall be incorporated in Categories 6 and 7 of the Phase II test as "Active Equipments" as required in paragraph 5.1.2(e)(5) of MIL-STD-1605.

4.4 Before starting Phase II testing perform a complete visual check of the vessel topsides including rigging and masts. Inspection shall ensure there are no loose, rusty, or dirty bond strap, ground, or antenna connections. Correct all deficiencies before starting Phase II of test.

4.5 During Phase II energize each transmitter in turn and check for adverse effects on other vessel equipment and radio receivers. MCF radios (VHF-FM, Handy-Talky, and SINCGARS (if installed)) are the monitoring receivers during this phase of the test. No VLF, LF, HF, UHF, RADAR, or SONAR equipment is installed on MCF. Therefore, perform Phase II test categories as listed below.

Category	Active Equipment	Monitoring Equipment
3	Transmitters, VHF & above (VHF-FM, Handy talky, & SINCGARS)	Receivers VHF & above (same as transmitters)
6	Miscellaneous active equipment (From Phase I)	Receivers (all radios)
7	All active equipments from above (transmitters and miscellaneous equipment)	All monitor equipment from above, and other vessel systems (steering, main engine, alarms)

4.5.1 During Category 7 testing energize the transmitters in different combinations while monitoring all systems for adverse effects. During the conduct of Phase II interference effects shall be recorded and assigned a level of severity as defined below. Interference to contractor furnished equipment of medium and severe levels shall be corrected. Mild interference and interference to Government furnished equipment shall be documented on the test report.

4.5.1.1 Mild Interference, although detectable, does not hamper the detection and interpretation of a desired signal. Mild interference to a control or monitoring system is detectable but does not result in operation of the equipment or system outside of tolerance limits. This level of interference is mainly a background or nuisance type.

4.5.1.2 Medium Interference, interferes with the detection and interpretation of a desired signal. This level of interference causes partial breakup or masking of a desired signal with some loss of signal content. Medium interference to a control or monitoring system is a temporary system maloperation, without danger to personnel, vessel, or mission, from which the system recovers without operator intervention.

4.5.1.3 Severe Interference, results in complete loss of a desired signal or interference to the extent that desired signal information of message content cannot be interpreted. Severe interference to a control or monitoring system causes undesired system operation from which the system does not recover by itself, or which could result in a hazardous situation for personnel, vessel, or mission.

5.0 ACCEPTANCE CRITERIA

5.1 The test will be successfully completed when all identified medium and severe sources of EMI have been identified and corrected.

5/8/95

INTERFERENCES NOTED:

① WHILE OPERATING "SINCGARS" RADIO, KEYING OF "ROSS" TRANSMITTER CAUSED NOISE ON PILOT HOUSE "SINCGARS" RECEIVER.* (NO EFFECT ON "SINCGARS" BEING MONITORED AT STERN OF MCF). PROBLEM WAS CORRECTED BY LOOPING WIRE 392A (OUTPUT OF 24-12 VDC CONVERTOR FEEDING "ROSS" SET) TWICE THROUGH A FERRITE INDUCTOR IN J-BOX BELOW 24-12 VDC CONVERTOR.

*NOTE - INTERFERENCE WAS NOTED WHEN KEYING ON "LOW" SETTING, CHANNELS 68, 69, 79.

- NO OTHER PROBLEMS ENCOUNTERED. -

LSI 03168

LSI REP - Ken Nelson 5/8/95
JOHN CURRY - "MET LABS"

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MICHIGAN

DATE October 19, 1994

TR-1073-AR-017
CDRL A010

EMI/EMC TEST

TEST REPORT

TR-1073-AR-017

CUSTOMER ATCOM

CUSTOMER P.O. NO. DAAK01-93-D-0007

EQUIPMENT MODULAR CAUSEWAY FERRY

SHOP ORDER N/A

TEST COMPLETION DATE MAY 8, 1995

Location	Item	Reading	Severity Class	Proposed Corrective Action
SINCGARS/ROSS			SEVERE	FERRITE INDUCTOR INST. ON "ROSS" POWER LINE.

(Use additional sheets as required)

SEE MET LAB REPORT EMI 356 OF 5/12/95 ATTACHED

Test Witnessed by:

LSI Rep Ken Nelson 5/9/95 Customer Rep Donald R. [illegible] 09 MAY Other _____

Ref TP-1073-AR-017

EMI TEST REPORT
FOR A

Modular Causeway Ferry
Model Number E03155
S/N: P40P-0001 & P40P-0002

MET REPORT EMI356

PREPARED FOR:

Lake Shore, Inc.
P.O. Box 809
Iron Mountain, MI 49801

PREPARED BY:

MET Laboratories, Inc.
914 WEST PATAPSCO AVENUE
BALTIMORE, MARYLAND 21230-3432

EMI TEST REPORT
FOR A

Modular Causeway Ferry
Model Number E03155
S/N: P40P-0001 & P40P-0002

MET REPORT EMI356

PREPARED FOR:

Lake Shore, Inc.
P.O. Box 809
Iron Mountain, MI 49801

PREPARED BY:

MET Laboratories, Inc.
914 WEST PATAPSCO AVENUE
BALTIMORE, MARYLAND 21230-3432

Test Engineer: J. Curry, MET

Witnessed by: William Keller, Lake Shore, Inc.

Army Representative

cc: Sandy Perocheschi w/ENCLOSURES 5/16/95 2 copies
PO FILE
Tom Csmarich w/o ENCLOSURE

Table Of Contents

1.0 Purpose of Test

The purpose of this evaluation was verify compliance of the Lake Shore Modular Causeway Ferry, Model Number E03155 (referred to as EUT hereafter) with MIL-STD-1605 (SHIPS) as indicated in Lake Shore, Inc. Purchase Order 109915-00. The evaluation was required as a result of new construction.

2.0 Test Sample

The EUT consisted of two power modules, serial numbers P40P-0001 & P40P-0002, and several modular non-powered sections to comprise a test ferry approximately 80 feet long by 20 feet wide. Each power module is comprised basically of one V8 diesel engine, a "thruster" (propulsion device), and associated control electronics. The ferry is equipped with one SINCGARS transceiver, one VHF ship-to-shore VHF transceiver (Ross Model DSL500) and one handheld VHF ship-to-shore VHF transceiver (Motorola Triton). In addition to these known transmitters, the following shipboard electronics were identified as potential interference sources: engine governor, engine rev. limiter switch, thruster synchronizers, 24VDC —> 110VAC inverter (required by synchronizers) and 24VDC —> 12VDC converter (required by stationary VHF ship-to-shore).

The ferry was designed in accordance with the guidelines set forth in MIL-STD-1310. All topside electronics are housed in the pilot house. Power is fed from a battery supply located below-deck. Interconnections between the power modules is accomplished via conduit which runs across the deck of the ship. Visual inspection of the bonding and grounding revealed nothing unusual. All terminations were clean and neat using "typical" electrical connectors.

A copy of NAVSHIPS 0967-266-1010, "Hull Generated Intermodulation Interference Reduction Techniques for Forces Afloat" was not present aboard the ferry; however, as the ferry does not contain 6 or more VHF transmitters, this requirement truly is not applicable. Further, due to the small number of transmitters, multicouplers and RF filters were not necessary. As the ferry does not utilize RADAR, blankers were not required either.

3.0 Disposition of Test Sample

All testing performed at:

Fort Eustis
Fort Eustis Boulevard
Newport News, VA 25602

4.0 References

MIL-STD-1605 (SHIPS)	Procedures for Conducting a Shipboard Electromagnetic Interference (EMI) Survey (Surface Ships)
MIL-STD-1310	Shipboard Bonding, Grounding and Other Techniques for Electromagnetic Compatibility and Safety
MIL-STD-45662A	Calibration System Requirements
Lake Shore, Inc. purchase order 109915-00	

5.0 List of Abbreviations

EUT **E**quipment **U**nder **T**est
dB **D**ecibel
R.E. **R**adiated **E**missions
V/m **V**olts per **M**eter
Hz **H**ertz
dBμV **D**ecibel Microvolts
kHz **K**ilohertz
MHz **M**egahertz
S/N **S**erial **N**umber
STD **S**tandard
EMI **E**lectromagnetic **I**nterference
W **W**att

6.0 List of Required Tests

In accordance with MIL-STD-1605 (SHIPS), testing is to be performed in two phases. Phase I identifies on-board electrical devices which have the potential to interfere with on-board receivers. (All on-board electronics and transmitters are assumed to be potential sources of interference.) Basically, the determination is made by spot-checking the emission levels at 150 kHz. If the emission levels exceed 50 μV/m/5kHz, then the emission levels at 2 MHz should be spot-checked as well. The emission levels at 2 MHZ should not exceed 15 μV/m/5kHz. In the event emission levels at both frequencies exceed their respective limits, then the entire 150 kHz - 25 MHz band must be scanned to determine the maximum emission level.

Once equipment with the potential for interference has been identified Phase II testing is conducted. Phase II basically involves operating all permutations of transmitters, electronic equipment, and electrical equipment identified in Phase I as potential interference sources, trying to identify susceptible receiving systems. The actual on-board receivers are electronic systems are used as the monitoring devices. There are no arbitrary emission/susceptibility level limits imposed. A given device is either susceptible, or it is not.

Phase I is performed dock-side; Phase II is conducted with the ship underway. The intent of Phase I tests is merely to minimize the amount of testing required in Phase II by eliminating electrically "quiet" devices from the test matrix.

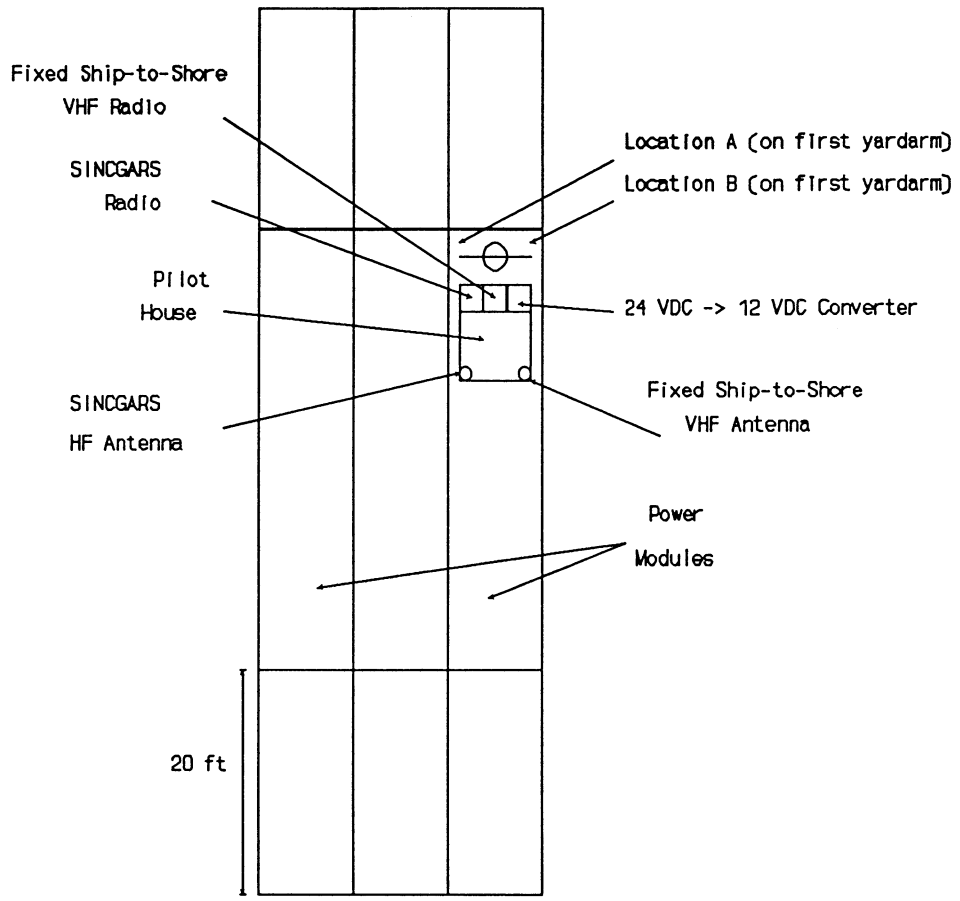
7.0 Modifications to EUT, Standard Limits and Test Frequencies

Due to high ambient levels, Phase I testing could not be (accurately) performed. However, as all electrical systems operate while under way anyway (with the possible exception of the windshield wiper motor), it really did not matter.

8.0 General Test Setup

All tests were conducted with Modular Causeway Ferry configured as shown below. The ferry was operated for a period of approximately 2 hours, during which time trials were being conducted. While the ferry was not loaded, this should have no effect on the EMI characteristics. In fact, this probably represents the worst-case scenario, as the ferry's engines may not be capable of achieving maximum rpm under load. For example, if the engines did not achieve full speed, the electronic engine governor would not operate. Further, the alternator will exhibit higher frequency emissions the faster it is turned.

Figure 1. General Test Setup



Notes:

Antennas mounted on top of pilot house -- pilot house approximately 6.5 feet tall

First yardarm approximately 8 feet from deck

9.0 Results

With the ferry underway, the pilot-house gauges and general handling characteristics of the ferry were observed without any transmitters in operation. As aforementioned, all electrical systems are active when the ship is running, so this "test" checked for interference between the electrical systems and the electronic navigation systems. None was observed.

Next, the SINCGARS transceiver was operated to test for inference between it and the on-board electrical and electronic systems. This test was facilitated by use of a second SINCGARS transceiver located as far aft as possible. No interference was observed.

Next, the (fixed) ship-to-shore VHF was operated while checking for interference to the SINCGARS receiver. It was observed that whenever the ship-to-shore was "keyed-up," interference on the SINCGARS occurred, especially upon release of the microphone button. Next, the hand-held VHF ship-to-shore radio, whose main purpose is really for intra-ship communications, was tested but no such interference was observed.

There were three main differences between the hand-held VHF and the fixed VHF:

(1) The fixed VHF typically operates at 25W, whereas the hand-held is restricted to 5W or less in order to conserve battery power.
(2) there was only (approximately) 3 feet separating the SINCGARS' HF antenna and the ship-to-shore's VHF antenna.
(3) The hand-held VHF was battery operated; the fixed VHF operated from ship power.

In order to test whether it was power-related, the transmit level of the fixed VHF was reduced to 1W. The interference was still observable, which led us to believe the problem was the result of the antenna placement. Unfortunately, moving the antennas about or rewiring the power source for the fixed VHF are not something that can be readily accomplished while underway.

This was the only observed interference while underway. Upon returning to port, further testing was conducted to determine the cause of this interference. First, the antenna was moved to location 'A'. (Reference Figure 1.) The interference lessened, but was still quite noticeable. This seemed to support the antenna spacing theory. Next, the antenna was moved to location 'B'. Although the spacing (from the HF antenna) was actually somewhat further, the interference worsened.

Further inspection revealed that the 24VDC => 12VDC converter used to supply power to the fixed VHF was located directly under location 'B'. Suspecting the converter was susceptible to inductive pick-up (because the interference was worse when the microphone button was released), a ferrite bead was installed over the 12 VDC power lead. This wire is designated '392A' on Lake Shore's wiring diagrams. This reduced the interference greatly, but not totally. Another wrap of the power lead was placed through the ferrite bead. The interference was no longer observable. This was tested over a range of VHF channels (low, middle and high) and both power levels.

The antenna was remounted at its original location. Again, no interference was observed.

(attachment to test procedures/reports)

EQUIPMENT Modular Causeway Ferry (MCF)

JOB NUMBER 1073 AR

SERIAL NUMBER Hull # 1

TR-1073-AR-018 MCF Interoperability

This test report/procedure has been reviewed and is properly signed off. All data blanks and tables are filled in.

Q.C. INSPECTOR Edward L. Parker

DATE Jan 7, 1995

WILL KELLER

JUN X 6 1995

Notes on BACK SIDE

LAKE SHORE INC.
An Oldenburg Group Company
KINGSFORD, MICHIGAN

DATE October 19, 1994
REVISED May 3, 1995

TP-1073-AR-018
CDRL A010

MODULAR CAUSEWAY FERRY
MCF INTEROPERABILITY
TEST PROCEDURE

TP-1073-AR-018

CUSTOMER ATCOM

CUSTOMER JOB NO. N/A

CUSTOMER P.O. NO. DAAK01-93-D0007

HULL NOS. First Article

EQUIPMENT Modular Causeway Ferry

EQUIPMENT NO. E03155

EQUIPMENT SERIAL NOS. P40P-0001, P40P-0002 (Powered Modules)

CUSTOMER NOTIFICATION PRIOR TO TESTING 7 DAYS

ENGINEERING NOTIFICATION PRIOR TO TESTING 14 DAYS

LAKE SHORE SALES ORDER NO. 1073AR

DRAWN _____ DATE Oct 19, 1994

CHECKED _____ DATE Oct 19 1994

APPROVED _____ DATE Oct 19, 1994

QUALITY _____ DATE 10/19/94

TP-1073-AR-018
CDRL A010

Rev	Date	Appvl	Q.A.	Description
--	10/21/94		LSI 1 QA	Initial Issue
A	1/30/95	WJK		General editorial revision deleted ref. 2.4 and reference thereto. added joining instructions. Revised TR to allow for recorder initials.
B	4/17/95	WJK	LSI 1 QA	Revised page 8 of 8 per ATCOM comments (3/21/95 letter from Ben Oh)
C	5/3/95	WJK	K. Wian	Revised throughout to reflect change to dimensional analysis due to lack of availability of N/L Section.

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CDRL A010

MODULAR CAUSEWAY FERRY
MCF INTEROPERABILITY TEST PROCEDURE

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1.0 INTRODUCTION

1.1 Objective. The objective of the MCF Interoperability Test is to verify that each section of the Modular Causeway Ferry (MCF) (Powered Section, Intermediate Section, Beach/Sea End Section) has the ability to be connected to NL Causeway Sections and existing GFE MCS Sections. Testing shall demonstrate that the Powered Section and the Intermediate Sections of the MCF will connect to an NL Causeway Intermediate Section and an MCS Intermediate Section through the Navy Flexor/Shear Connector System.

1.2 Test Item. The test item, described as the MCF, is defined by Lake Shore drawing E03155. For testing, one Powered Section (E19203) and one Intermediate Section (E19193) will be used.

1.3 Test Limitations. MCF Interoperability Testing will be performed with the sections in water in an unloaded condition. MCF specifications require that unloaded freeboard be 40 $\pm$2 inches to accommodate interoperability (PD Para 3.5.22.1). To verify interoperability, NL and MCS Sections provided by the Customer for performance of this test must meet the MCF specifications for unloaded freeboard.

Interoperability of the MCF with NL Causeway Sections will be determined by test. Interoperability of the MCF with MCS Sections will be determined by extension of the Interoperability with the NL Section.

2.0 REFERENCE DOCUMENTS

2.1	PD 1990-0098	Purchase Description (Para's 4.5.2.7.9, 3.5.23, 3.5.22.1)
2.2	E20001	General Test Requirements
2.3	E20011	Failure Reporting, Analysis, and Corrective Action System (FRACAS)
2.4	6138992	Flexor System Assembly and Details
2.5	6138929	Pontoon Assembly/Detail Modified P-1

2.6	6138928	Pontoon Assembly/Detail (P-8 M/F)
2.7	6138921	Causeway Section Powered - Assembly
2.8	E02783	MCF Flexor System

3.0 TEST PREPARATION

3.1 Approach to Test. Interoperability of the MCF with NL Sections will be determined by a dimensional analysis of an MCF Powered Section, Intermediate Section and an NL Intermediate Section end-to-end through the Flexor/Shear Connector System. The analysis will be verified by actual measurements of a LSI Powered Section and a LSI Intermediate Section.

Interoperability of the MCF with MCS Sections will be determined by extension of the Interoperability with the NL Section.

3.2 General Test Requirements. Refer ref. 2.2 and 2.3 for general test requirements:

3.3 Government Notification. ATCOM and the Government Quality Assurance Representative shall be provided with seven (7) days notification prior to the start of testing.

3.4 Personnel Requirements. The following personnel are required for performance of the MCF Interoperability Test:

3.4.1 Contractor furnished personnel: Test supervisor and MCF test crew.

3.4.2 Government furnished personnel: Test witness.

3.5 Facilities and Test Equipment. The following facilities, support equipment, and test equipment are required for performance of the MCF Interoperability Test (CFE = Contractor furnished equipment, GFE = Government/Customer furnished equipment):

	CFE	GFE
3.5.1 One (1) complete MCF Powered Section, outfitted for duty and one (1) complete MCF Intermediate Section.	X	
3.5.2 Mooring lines and dockside equipment for mooring the MCF to the pier.		X
3.5.3 NL Causeway Intermediate Section drawings (Reference 2.4 through 2.7)		X

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4.0 TEST PROCEDURE

4.1 MCF Interoperability Testing will be performed after a section is assembled, and in the water, prior to connecting the sections into the 320 foot MCF configuration. Test data shall be recorded on the Test Report TR-1073-AR-018.

4.2 For each section, measure and record the freeboard. (For the MCF Sections, refer to Test Procedure TP-1073-AR-009 and Lake Shore Drawing E19993.)

4.3 Perform dimensional analysis using References 2.4 through 2.7 to determine locations of flexor and shear connector centerlines relative to the centerline of the C.S.P.

4.4 Verify centerline locations paragraph 4.3 are in agreement with Reference 2.8.

4.5 Survey LSI powered and intermediate sections locating transverse centerlines of the sections, pontoons, flexor and shear connectors. Determine as-built dimensions.

4.6 Compare dimensions of paragraph 4.5 to Reference 2.8 (see paragraph 4.4).

5.0 ACCEPTANCE CRITERIA

5.1 LSI MCF sections will be shown to dimensionally join to existing GFE N/L and MCS sections.

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MODULAR CAUSEWAY FERRY INTEROPERABILITY TEST

TEST REPORT

TR-1073-AR-018

CUSTOMER ATCOM

CUSTOMER P.O. NO. DAAK01-93-D-0007

EQUIPMENT MODULAR CAUSEWAY FERRY

DATE OF MEASUREMENTS _____

LOCATION _____

MCF Interoperability Test Results:

Unloaded freeboard measurements (Specified at 40 $\pm$2 inches)

	MCF Powered Section	MCF Intermediate Section	BY
Freeboard			

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Distance From Centerline To:	CSP Dimension	LSI Drawing Dimension - Int. Section	LSI As-Built Dimension - Int. Section	LSI Drawing Dimension - Powered Section	LSI As-Built Dimension - Powered Section	Notes
Center Module Female Connector	18.63	18.63	18.63	18.63	18.63	
Outboard Module LR Male Connector	* 85.0	85.50	85.50	85.50	85.75	SEE * BACK OF THIS SHEET.
Outboard Module LR Flexor Housing	115.0	115.0	115.0	115.0	116.25	GAP BTWN MODULE 150'S IS 3/8"
Center Module Male Connector	18.63	18.63	18.63	18.63	18.56	
Outboard Module RR Female Connector	85.50	85.50	85.63	85.50	85.88	
Outboard Module RR Flexor Housing	115.0	115.0	115.0	115.0	115.25	GAP BTWN MODULE 150'S IS 3/8"
Flexor Housing to Flexor Housing Dimension	230.0	230.0	230.0	230.0	230.50	EXCESS DUE TO GAP BTWN MODULES
Outboard Male to Outboard Female Connector	171.0	171.0	171.13	171.0	170.63	

NOTE:

(1) All dimensions to transverse centerlines.

SEE COMMENTS ON REVERSE OF THIS SHEET.

Acceptable ✓ Not Acceptable _____

Test Witnessed by: 95/05/08

LSI Rep Earl W. Parker Customer Rep Donald R. Bragg 8MAY95 Other _____

LSI 03022

THE NAVY DWG. 6138921 HAS A DISCREPENCY IN AS MUCH AS IF YOU FIGURE THE DIMENSION FROM THE OVERALL WIDTH OF 21'-4" WHICH IT IS. (SHT. 2 OF 8921 HAS A DIMENSION OF 21'-3" WHICH DOES NOT INCLUDE THE THICKNESS OF THE OUTBOARD ANGLES). USING 21'-4" WORKING TOWARDS THE SHIP'S CENTERLINE IT COMES OUT TO 85.50 FROM SHIPS CENTERLINE TO THE MALE CONNECTOR, IF YOU USE THE DIMENSION'S FROM THE CENTERLINE OF THE SHIP OUTWARD THE DIMENSION TO THE MALE CONNECTOR COMS OUT TO 85.0.